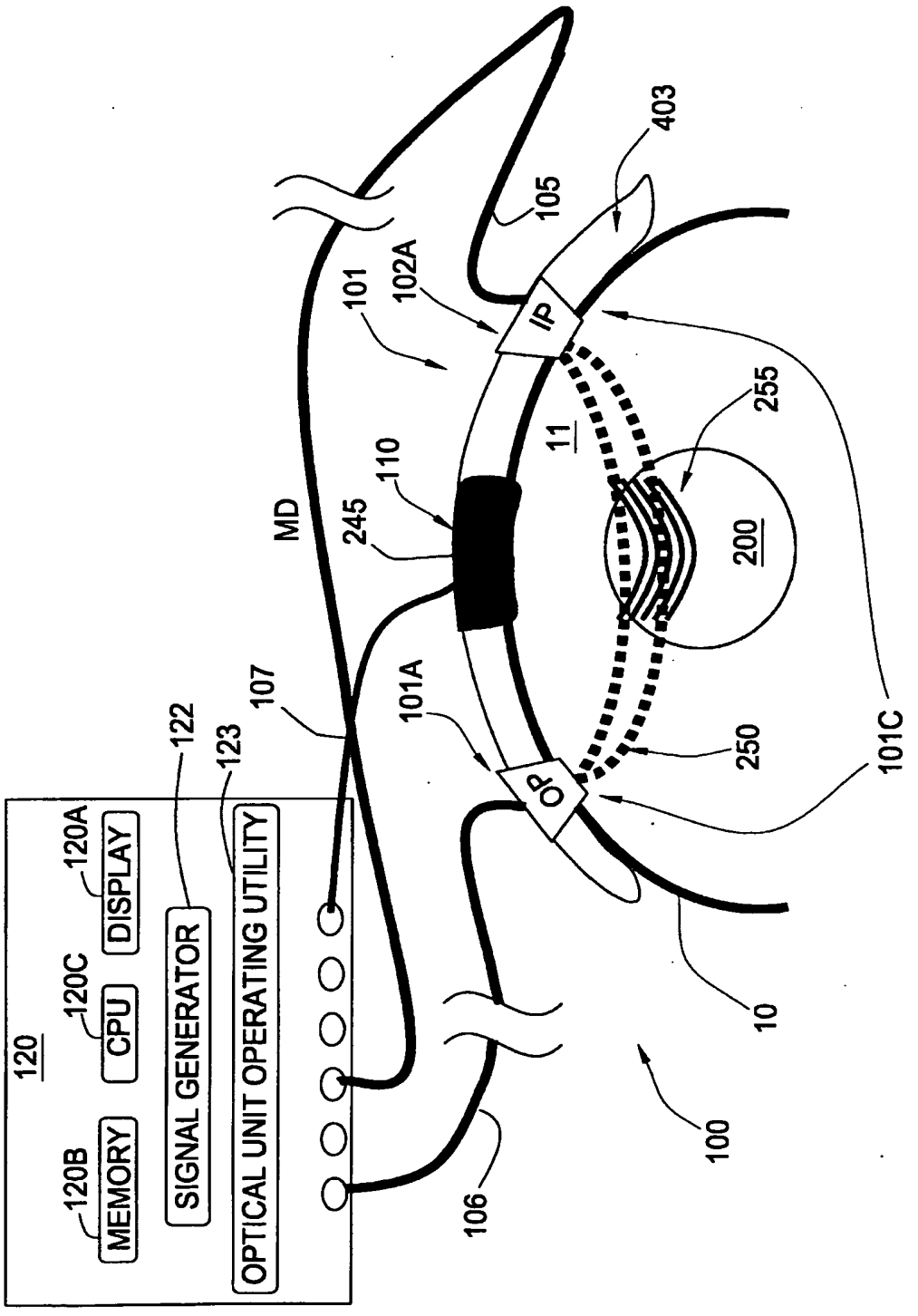
120
120A
DISPLAY
120C
CPU
120B
MEMORY
SIGNAL GENERATOR
OPTICAL UNIT OPERATING UTILITY
122
123
107
MD
101
102A
IP
105
403
110
245
11
255
200
101A
OP
250
101C
106
100
10

FIG. 1A

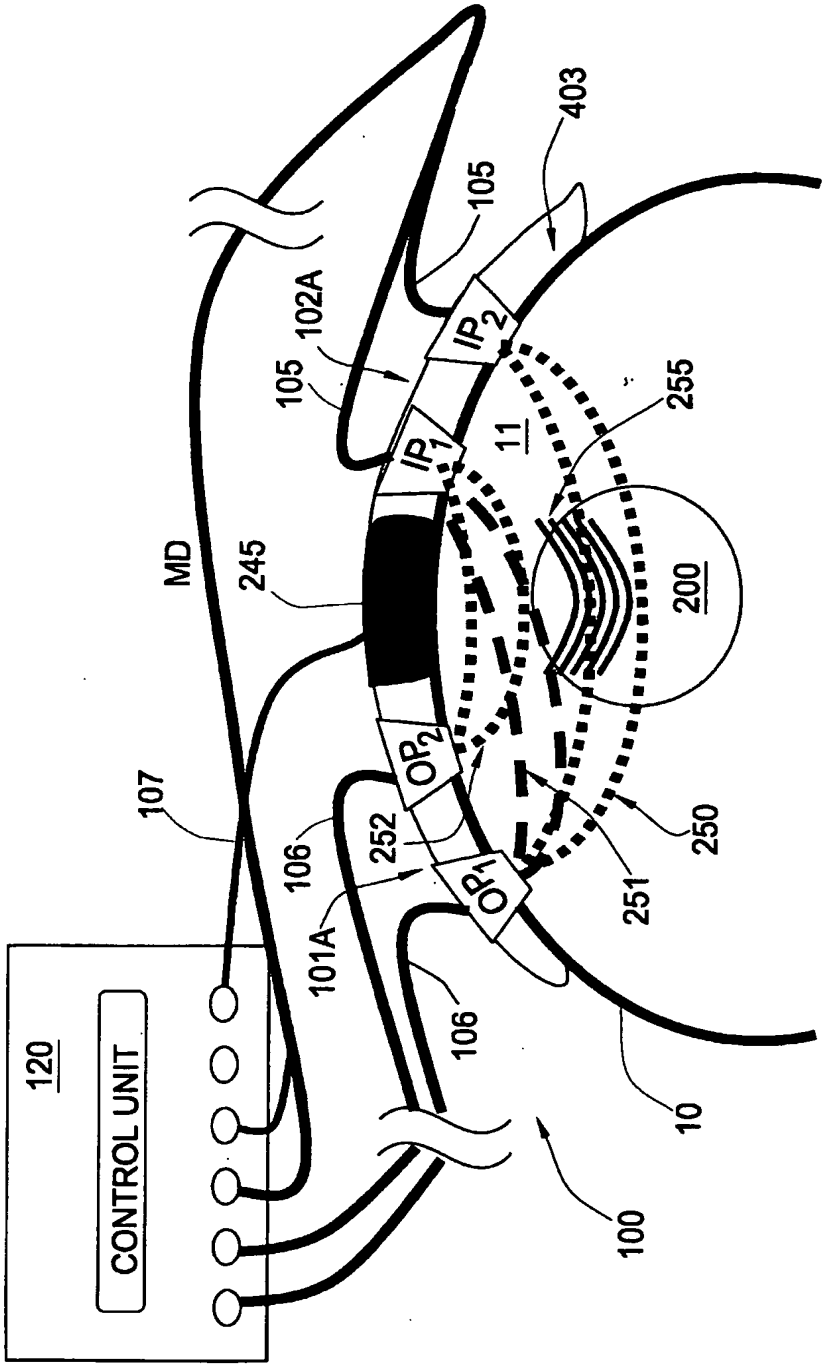
403
105
102A
105
IP2
IP1
11
255
MD
245
200
OP2
107
106
252
250
OP1
251
101A
106
120
CONTROL UNIT
10
100

FIG. 1B

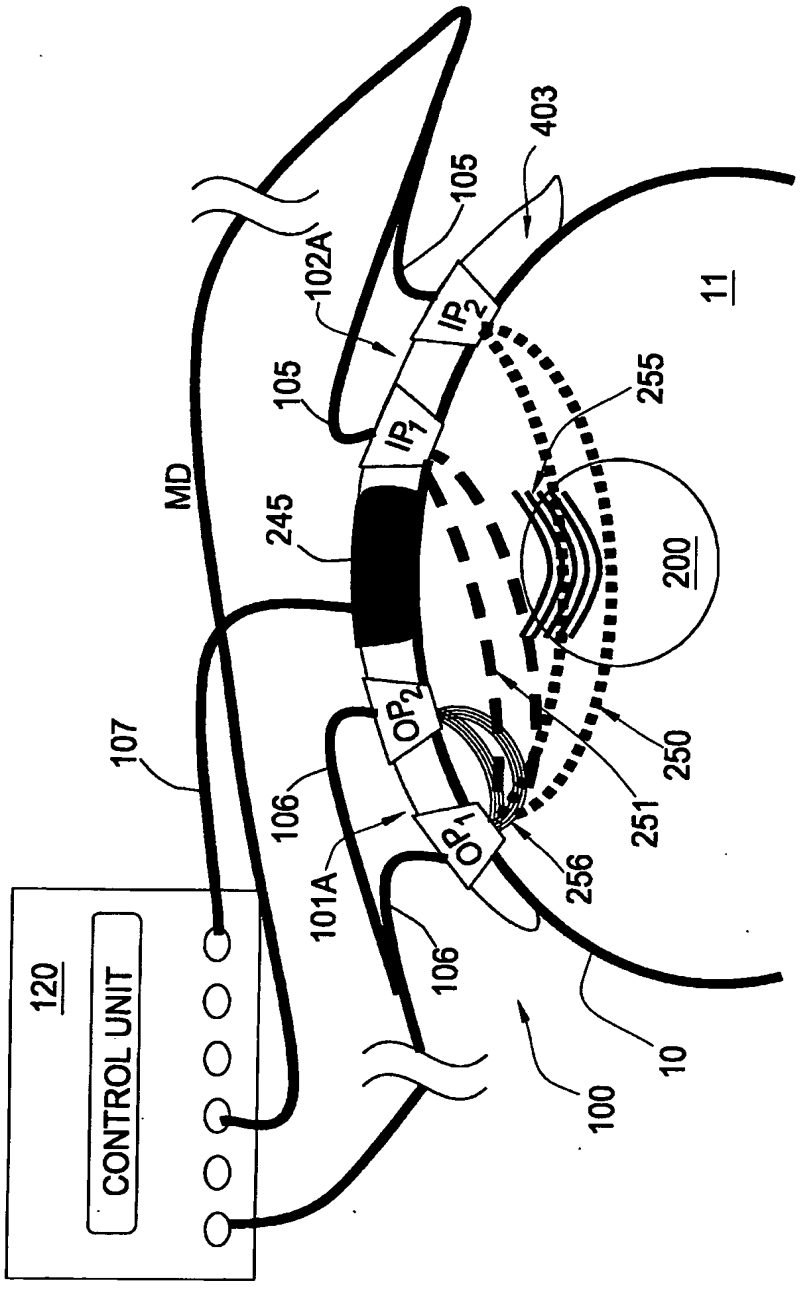
120
CONTROL UNIT
MD
107
106
101A
106
102A
105
105
403
11
255
245
200
250
251
256
10
100
IP2
IP1
OP2
OP1

FIG. 1C

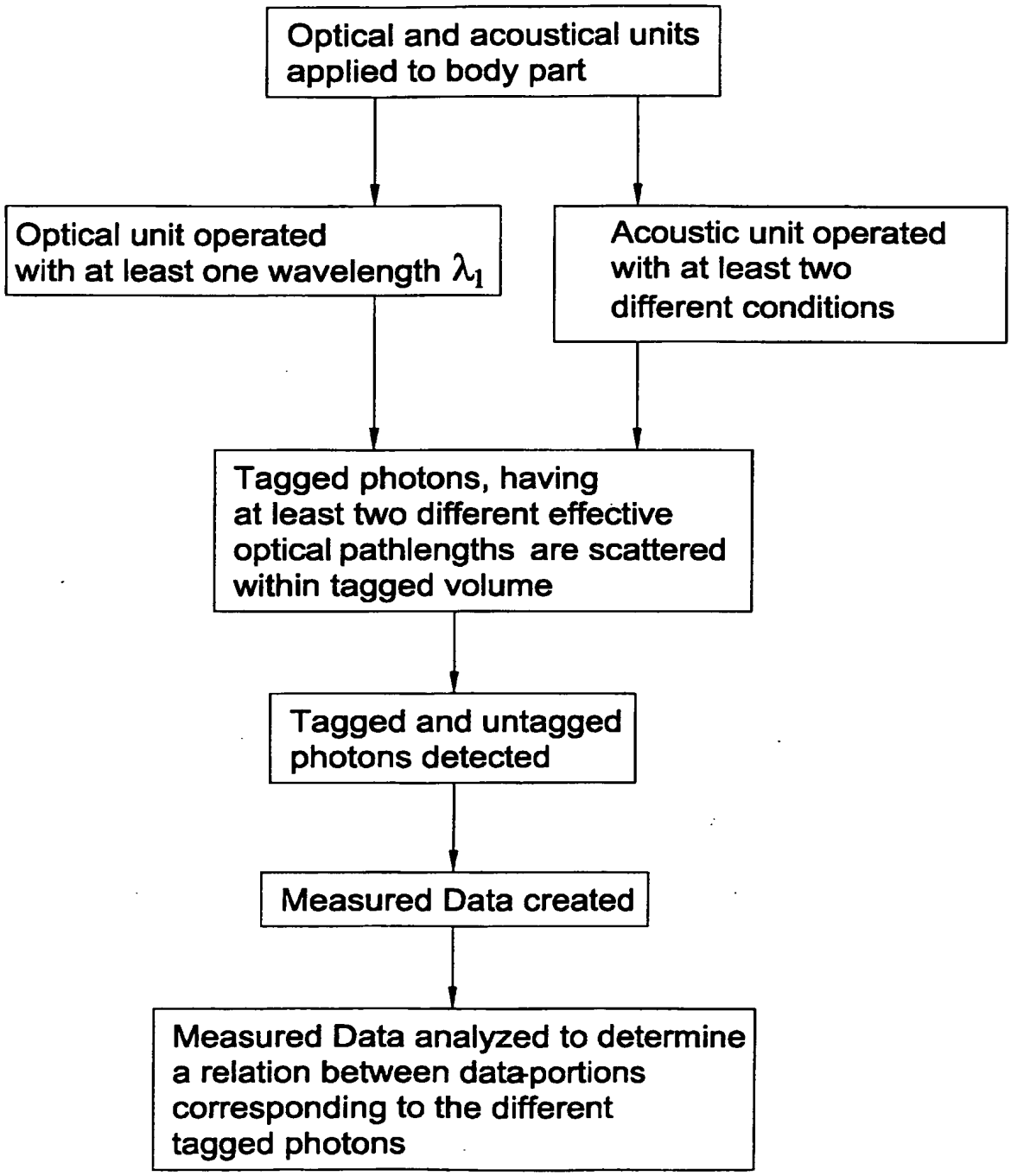
Optical and acoustical units applied to body part
Optical unit operated with at least one wavelength λ_1
Acoustic unit operated with at least two different conditions
Tagged photons, having at least two different effective optical pathlengths are scattered within tagged volume
Tagged and untagged photons detected
Measured Data created
Measured Data analyzed to determine a relation between data-portions corresponding to the different tagged photons

FIG. 1D

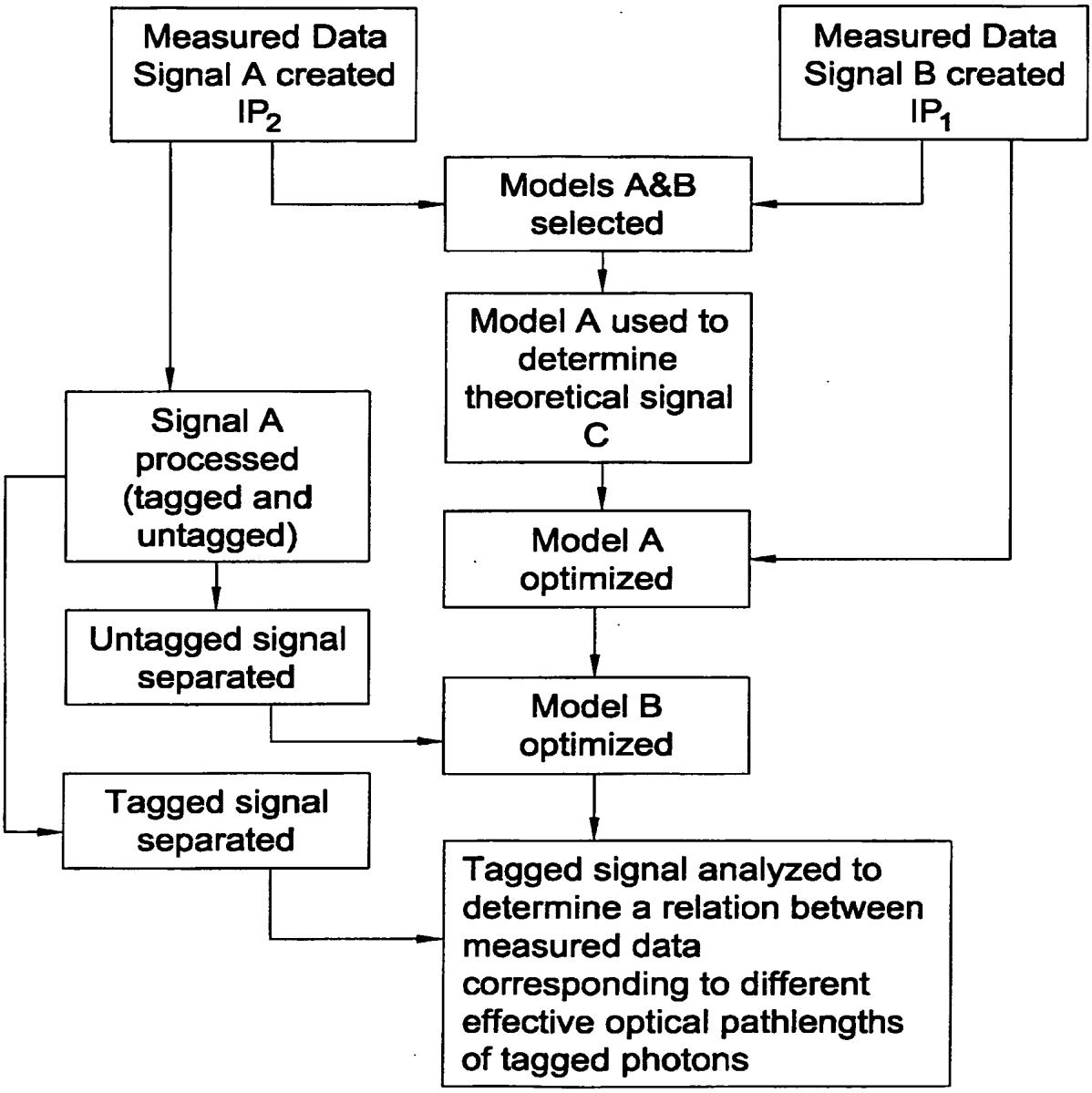
Measured Data Signal A created IP_2
Measured Data Signal B created IP_1
Models A&B selected
Model A used to determine theoretical signal C
Signal A processed (tagged and untagged)
Model A optimized
Untagged signal separated
Model B optimized
Tagged signal separated
Tagged signal analyzed to determine a relation between measured data corresponding to different effective optical pathlengths of tagged photons

FIG. 1E

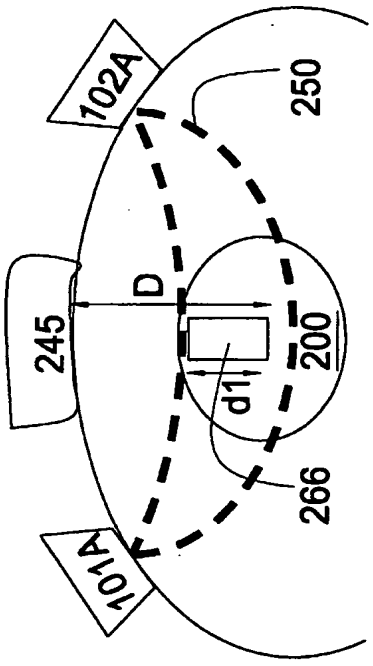
102A
250
D
245
200
d1
266
101A
T1

FIG. 2A

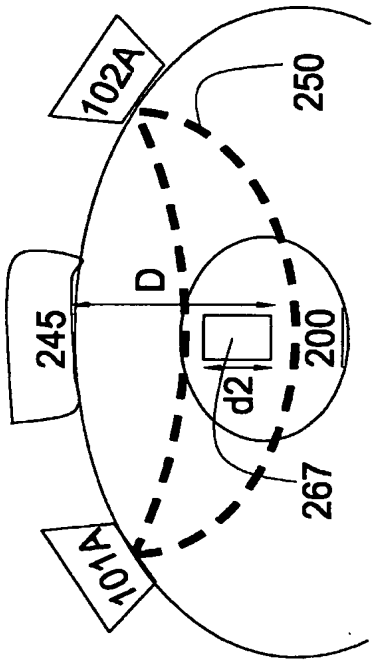
102A
250
D
245
200
d2
267
101A
T2

FIG. 2B

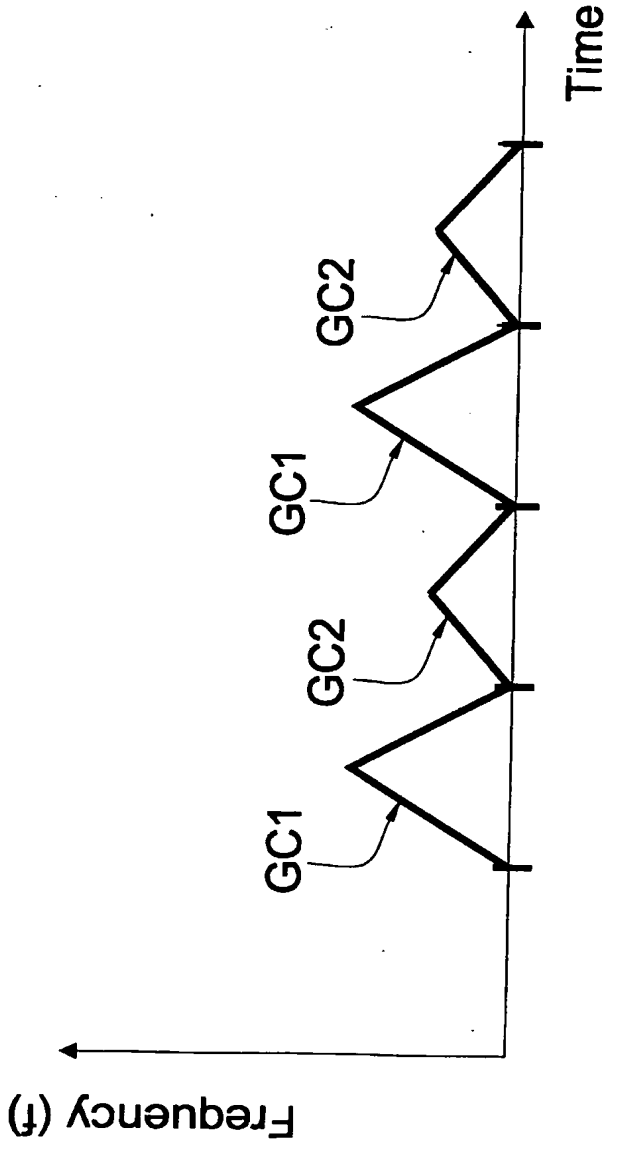

FIG. 2C

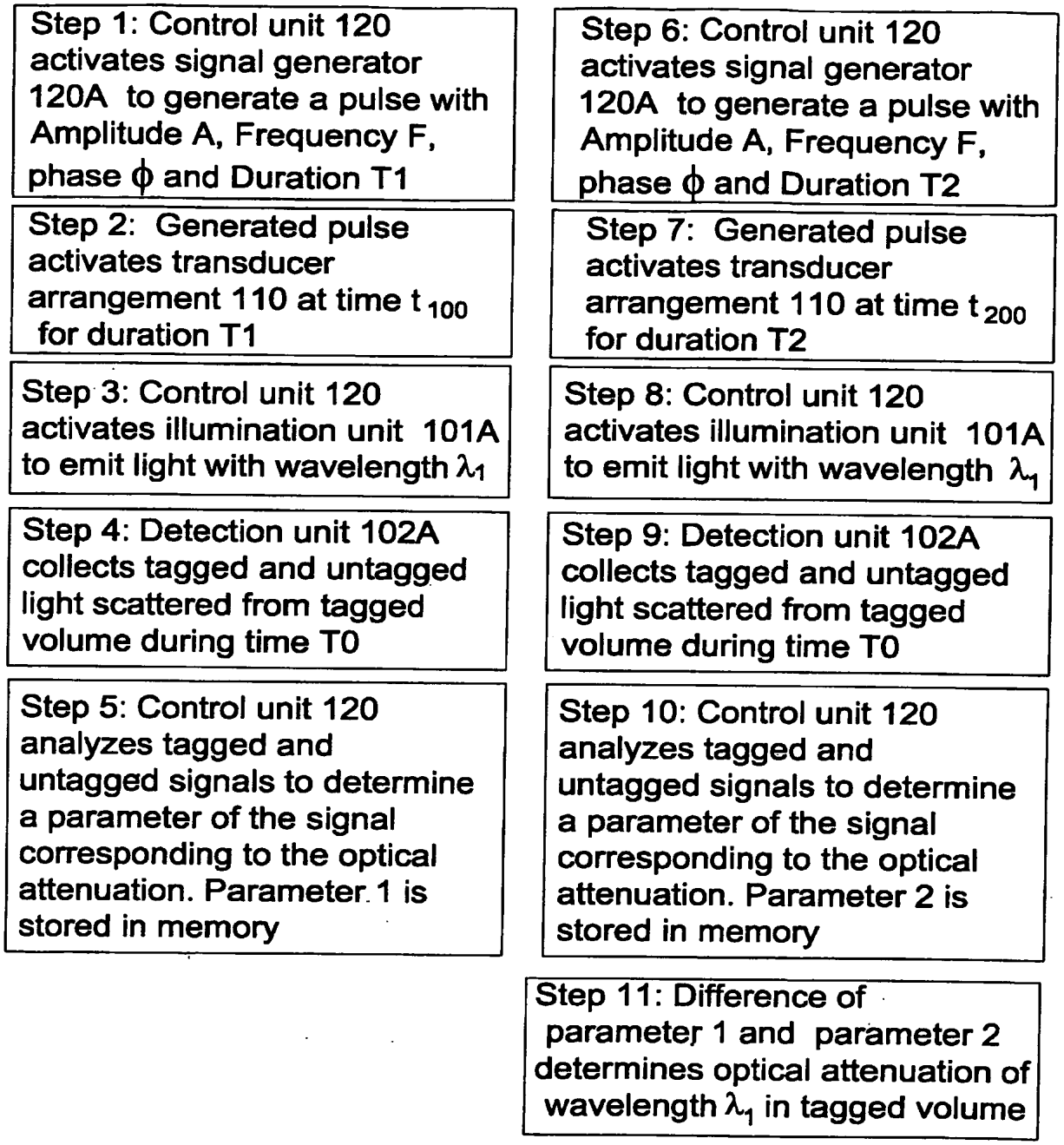
Step 1: Control unit 120 activates signal generator 120A to generate a pulse with Amplitude A, Frequency F, phase ϕ and Duration T1
Step 2: Generated pulse activates transducer arrangement 110 at time t_{100} for duration T1
Step 3: Control unit 120 activates illumination unit 101A to emit light with wavelength λ_1
Step 4: Detection unit 102A collects tagged and untagged light scattered from tagged volume during time T0
Step 5: Control unit 120 analyzes tagged and untagged signals to determine a parameter of the signal corresponding to the optical attenuation. Parameter 1 is stored in memory
Step 6: Control unit 120 activates signal generator 120A to generate a pulse with Amplitude A, Frequency F, phase ϕ and Duration T2
Step 7: Generated pulse activates transducer arrangement 110 at time t_{200} for duration T2
Step 8: Control unit 120 activates illumination unit 101A to emit light with wavelength λ_1
Step 9: Detection unit 102A collects tagged and untagged light scattered from tagged volume during time T0
Step 10: Control unit 120 analyzes tagged and untagged signals to determine a parameter of the signal corresponding to the optical attenuation. Parameter 2 is stored in memory
Step 11: Difference of parameter 1 and parameter 2 determines optical attenuation of wavelength λ_1 in tagged volume
Repeat steps 1- 11 with second wavelength of light λ_2 to determine optical attenuation in tagged volume. Ratio between optical attenuation at the two wavelengths determines oxygen saturation of the region of interest

FIG. 3

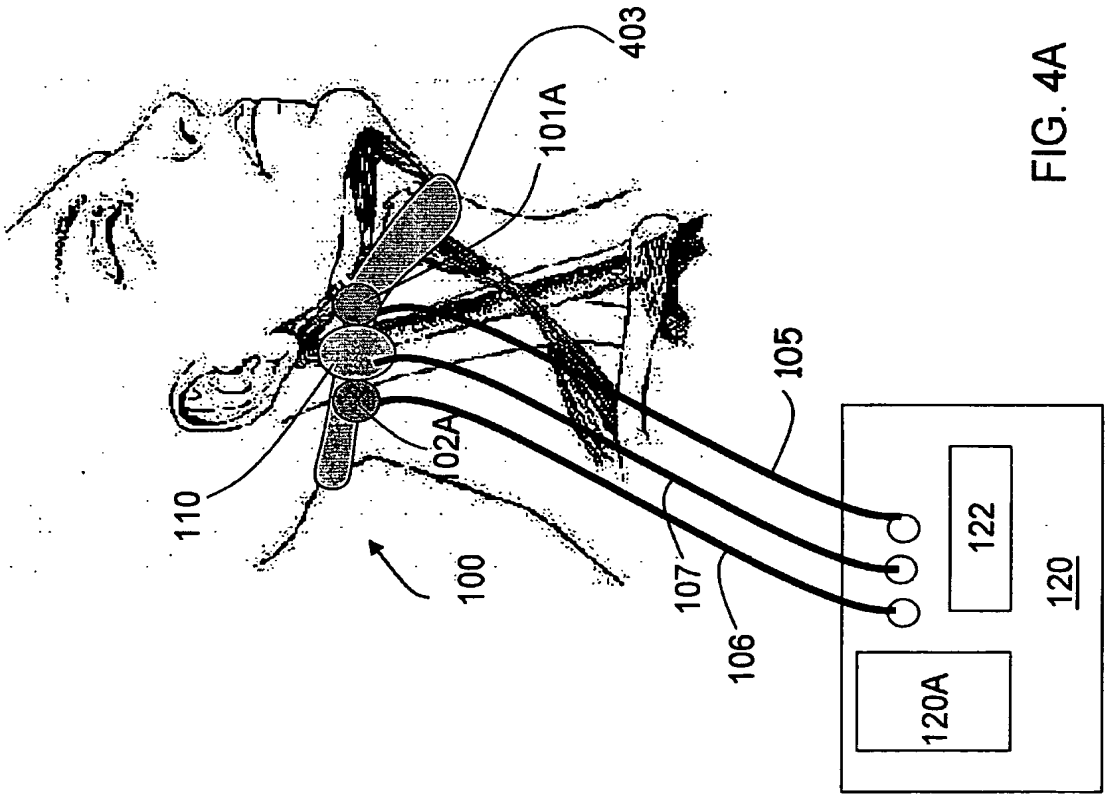

FIG. 4A

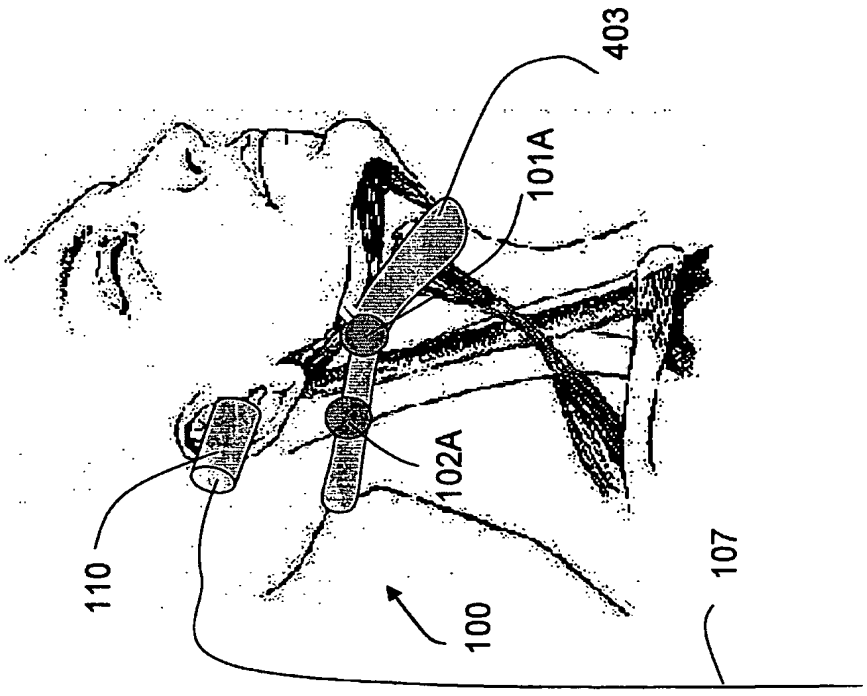

FIG. 4B

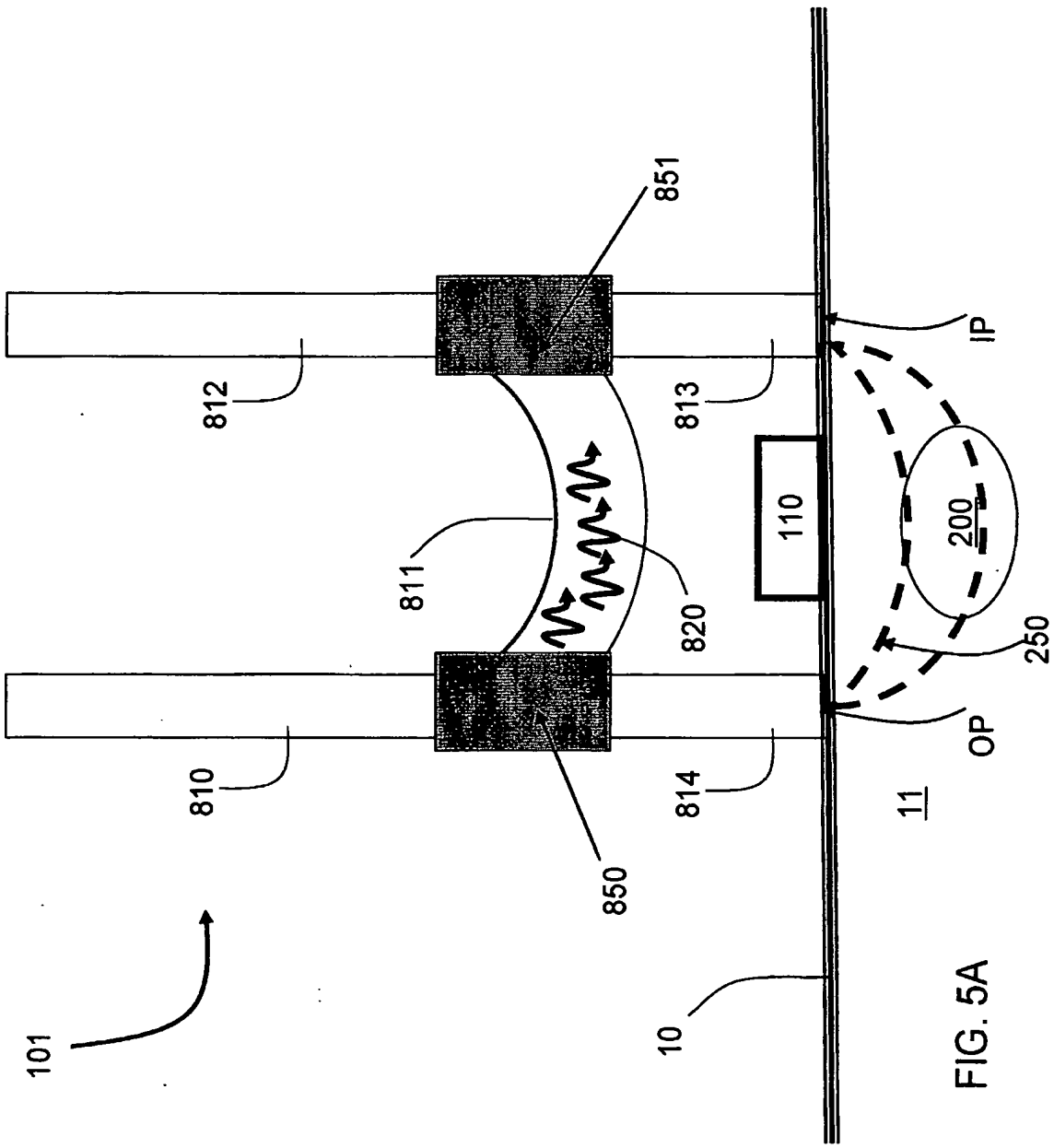

FIG. 5A

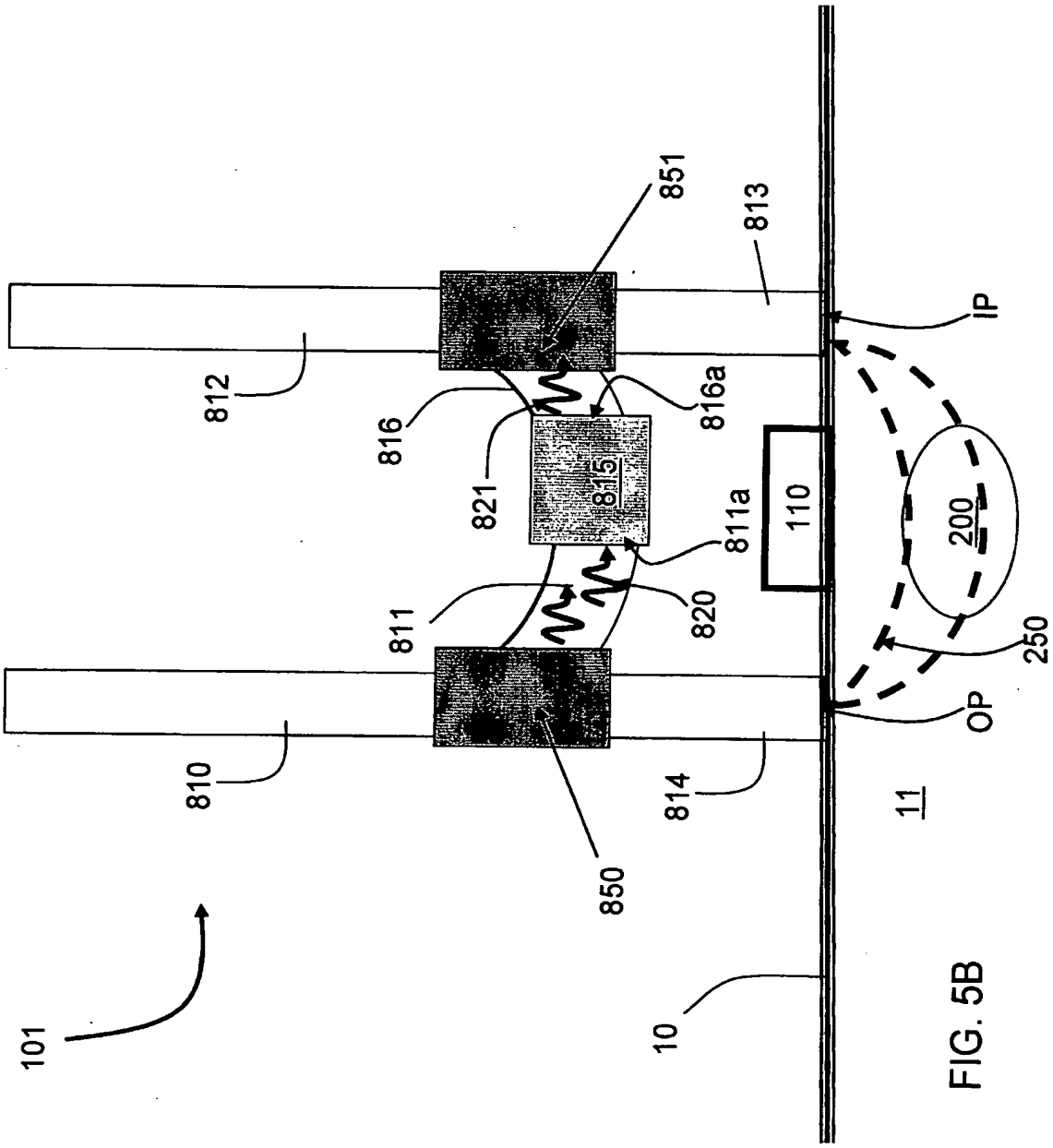
851
813
IP
812
816
816a
821
815
811a
110
200
811
820
250
OP
810
814
11
850
101
10

FIG. 5B

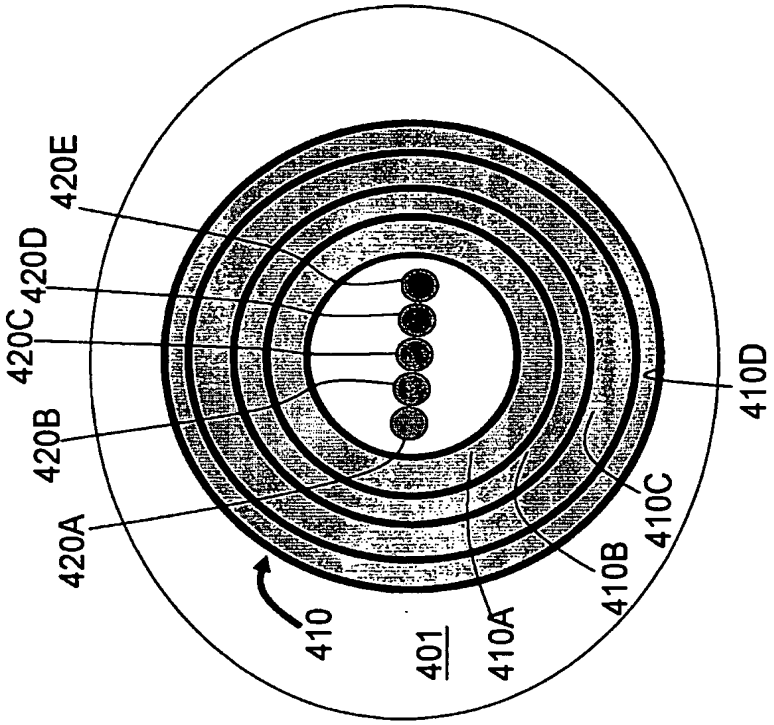

FIG. 6A

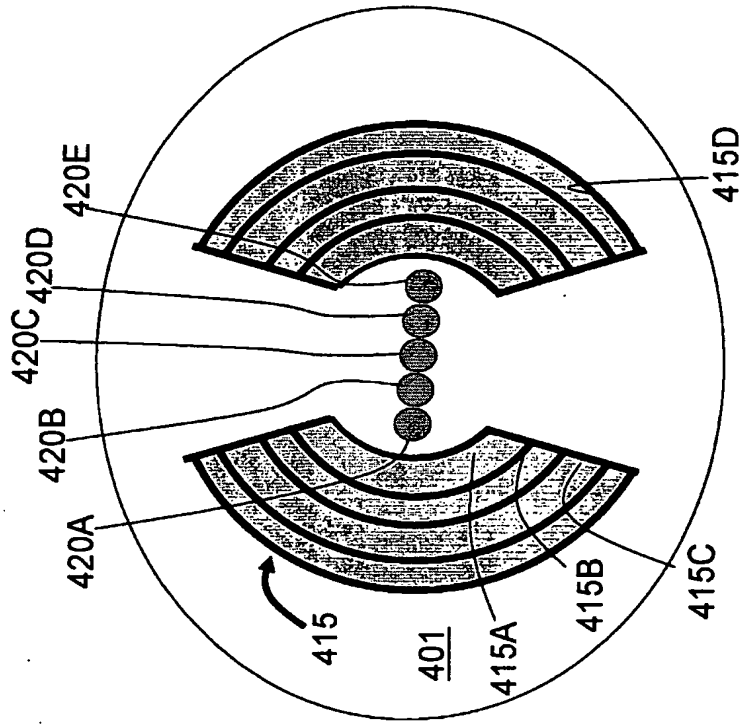

FIG. 6B

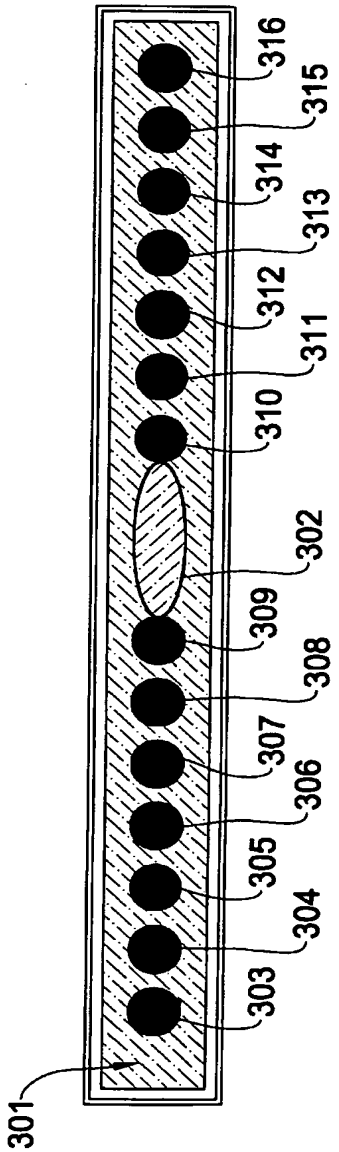
316
315
314
313
312
311
310
302
309
308
307
306
305
304
303
301

FIG. 7A

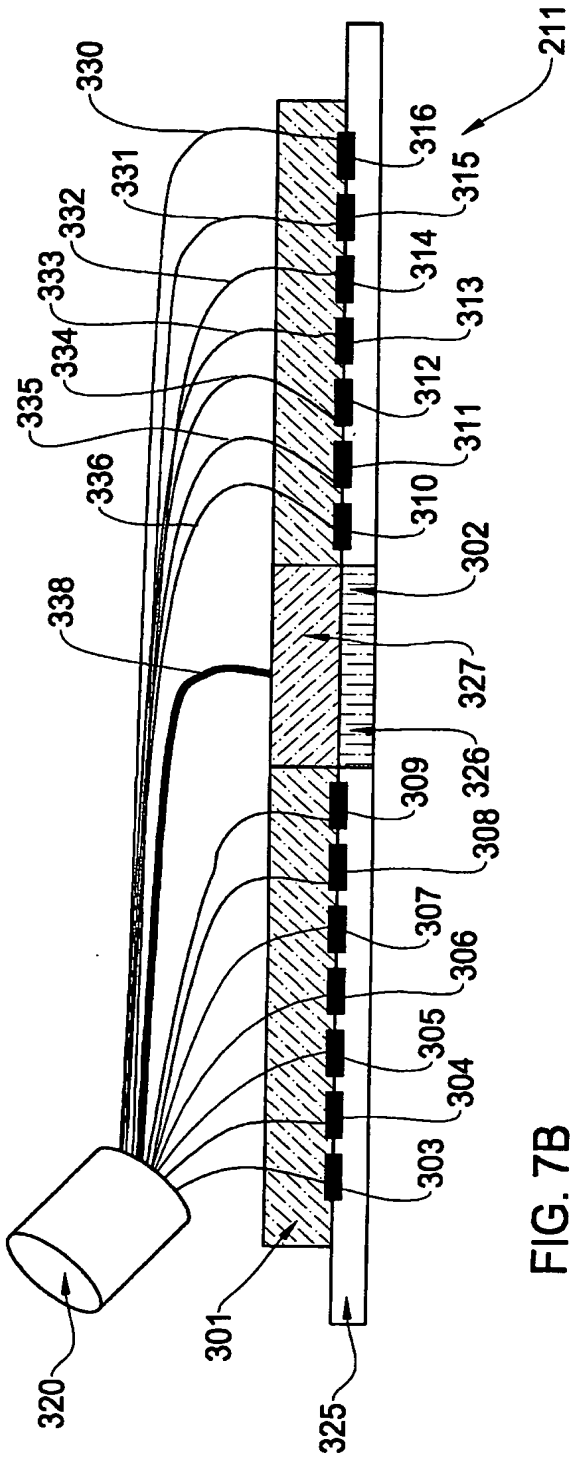
330
331
332
333
334
335
336
338
211
316
315
314
313
312
311
310
302
327
326
309
308
307
306
305
304
303
320
301
325

FIG. 7B

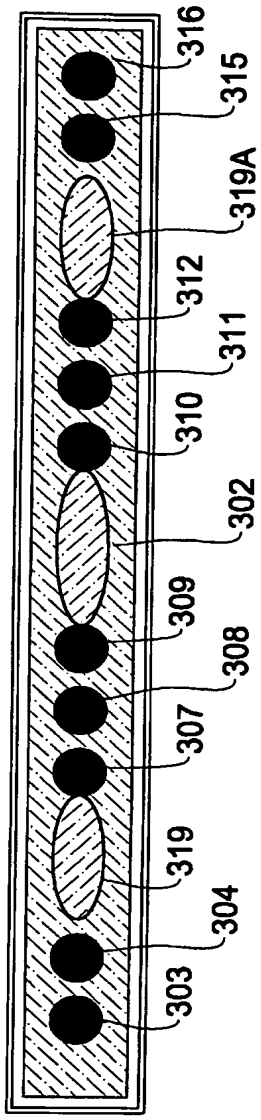
316
315
319A
312
311
310
302
309
308
307
319
304
303

FIG. 8A

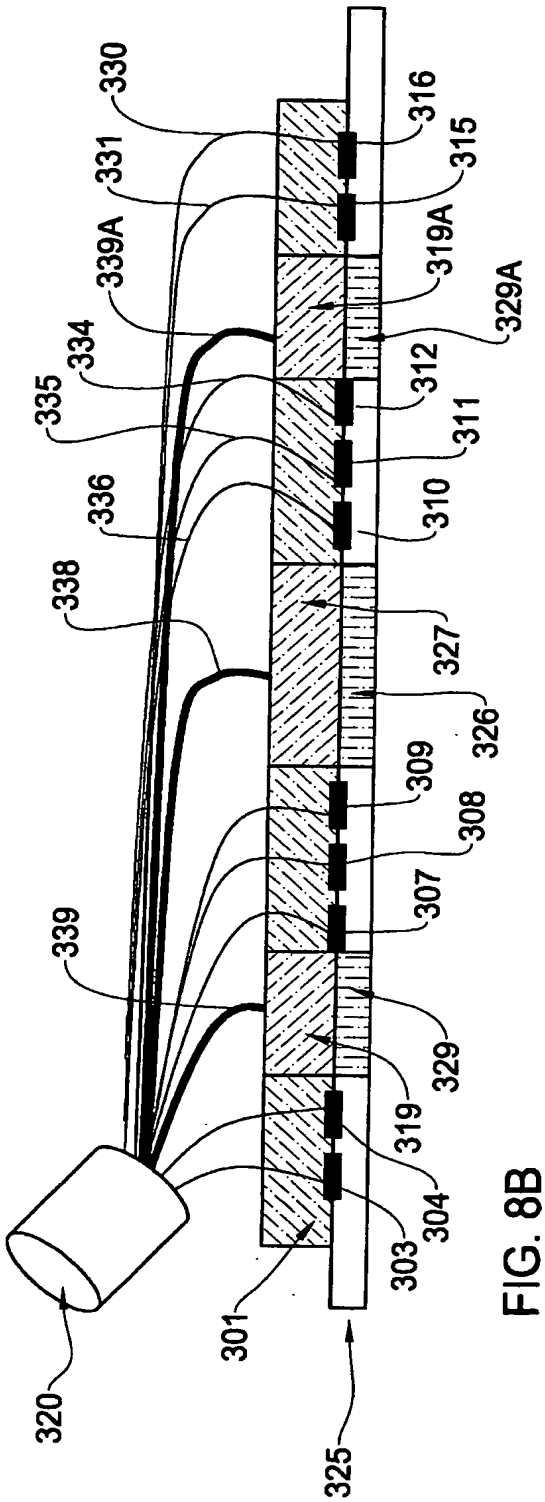
330
331
339A
334
335
336
338
339
316
315
319A
329A
312
311
310
327
326
309
308
307
329
319
304
303
320
301
325

FIG. 8B